

Overview of the Michigan Connected Vehicle Test Bed

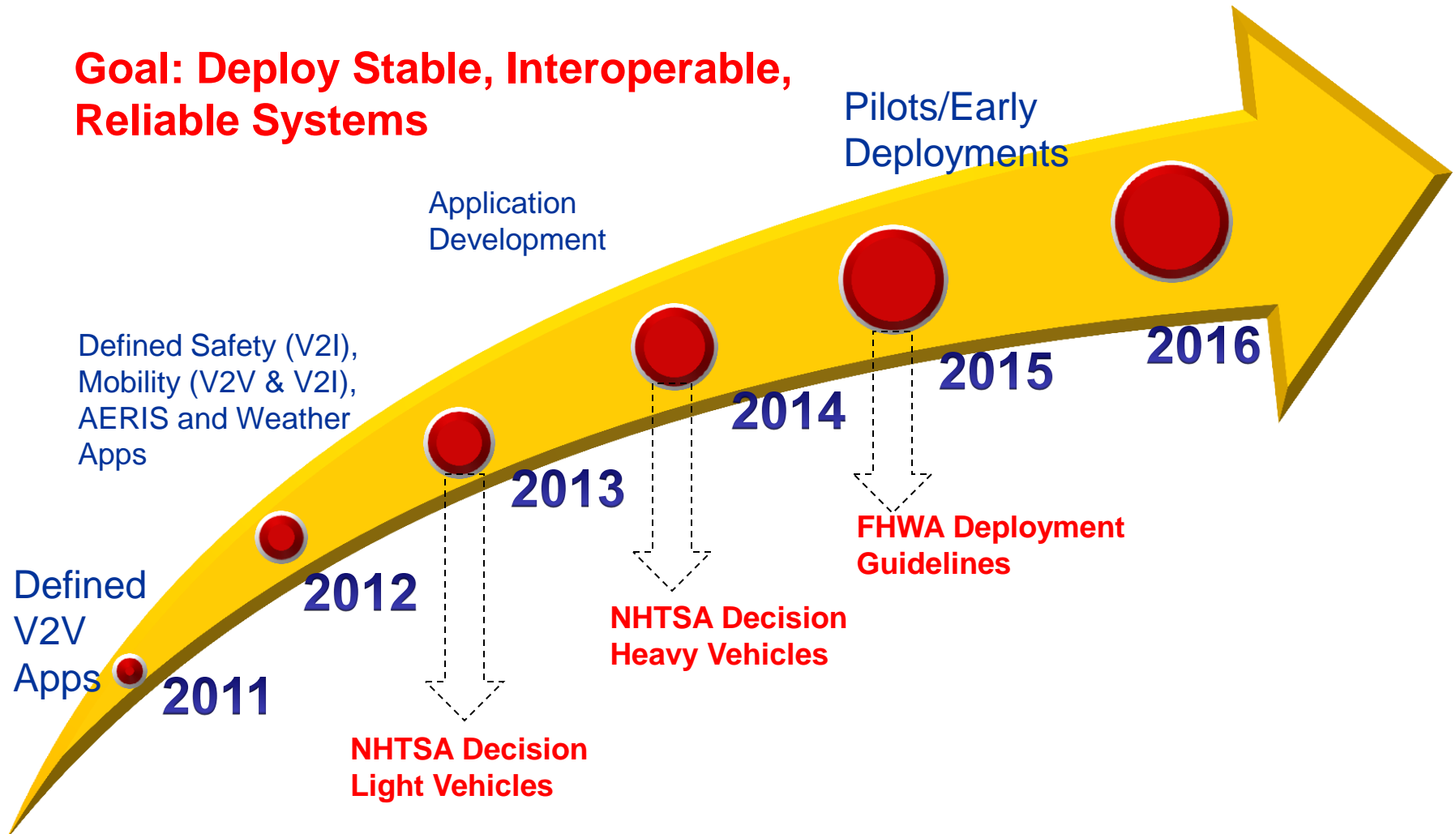
Southeast Michigan Connected Vehicle Test Bed 2014
Project Information Meeting
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Supporting US DOT and Industry Efforts Focused on Deployment

Goal: Deploy Stable, Interoperable, Reliable Systems



USDOT Test Bed Objectives

- Past objectives include:
 - Proof of concept – does 5.9 GHz DSRC technology work (and what issues does it have)
 - Outreach and education regarding connected vehicles – tours, demonstrations and outreach opportunities
- Current objectives include:
 - Supporting industry
 - Supporting other test and early deployments
 - Testing new concepts for deployment
 - Central System (Core or Back End)
 - Field deployments and components
 - In-Vehicle components



Overview of USDOT Test Bed

- Provide a facility to support testing and development of Connected Vehicle technologies, components & applications.
 - US DOT funded infrastructure & operations
- Established in 2007 to support the Proof of Concept testing
- Updated in 2010 to support more general testing and use
- Approximately 50 sites in southeast Michigan supporting applications including:
 - Signal Phase and Timing
 - Commercial Vehicles
 - Signage
 - Probe Data
- Central IT systems in Oak Ridge, TN
- Coordination with other Michigan Test Beds
 - Detroit
 - MDOT / ITS World Congress 2014
 - Ann Arbor Safety Pilot Model Deployment
- Work and integration with the USDOT Affiliated Test Beds

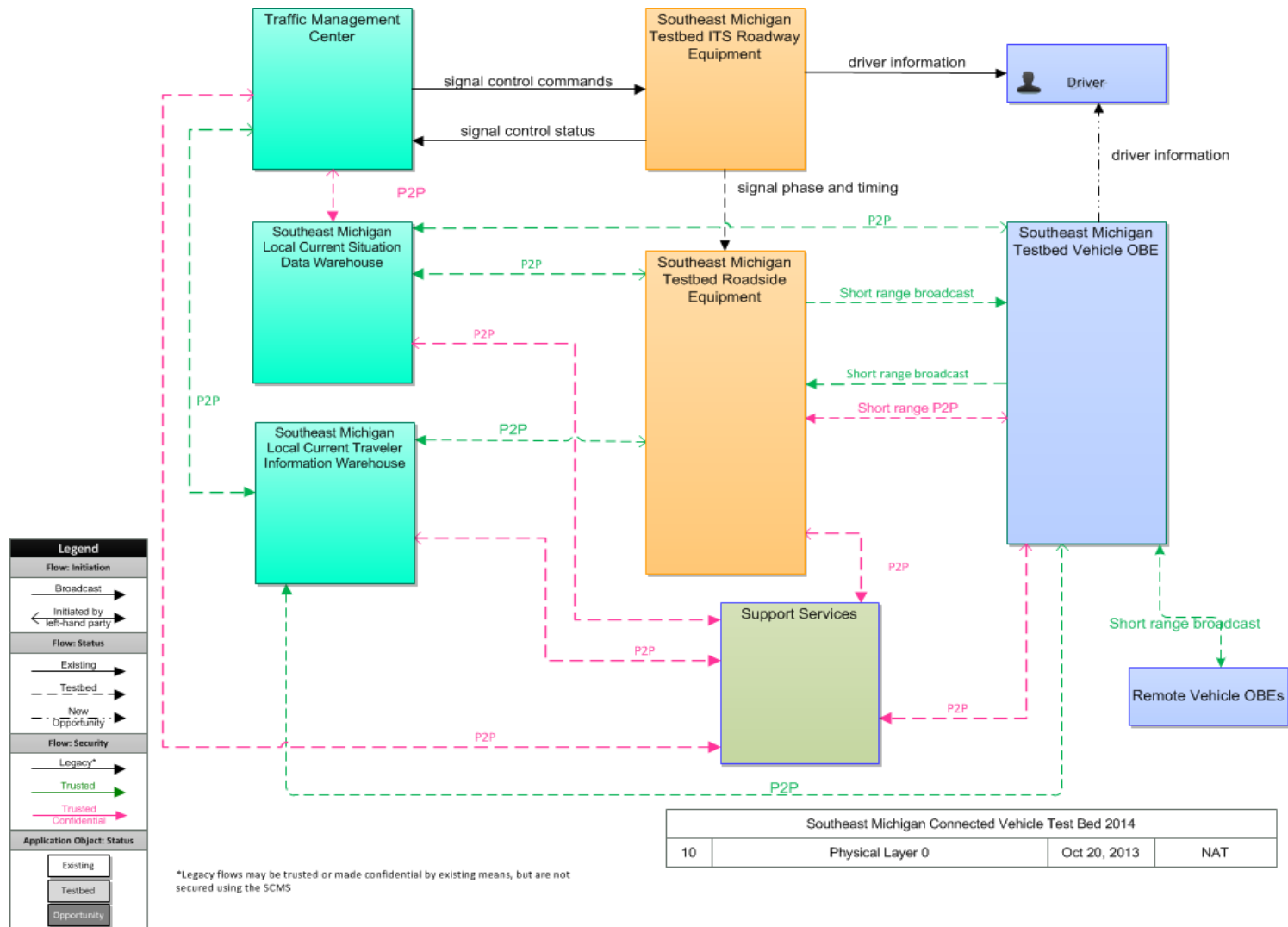


Overview of USDOT Test Bed Resources

- RSEs from on US DOT Research QPL (Model Deployment)
 - 5 vendors
- OBEs from USDOT Research QPL (Model Deployment)
 - Vehicle Awareness Devices
 - Aftermarket Safety Devices
- Portable RSE trailers
 - 2 in Michigan
 - 1 at Turner Fairbank Highway Research Center
- Network listeners / sniffers
- Test Bed Operations staff
- Signal Phase and Timing (SPaT) Resources
 - Listeners
 - Interface standards from FHWA
- Security Credential Management System (SCMS)
 - 1609.2 certificate management system



Test Bed Network Vision



USDOT Test Bed Resources

- Current Generation RSEs in Inventory / Deployed
 - 11 Arada RSEs
 - 10 Savari RSEs (on-order)
- ASDs in Inventory
 - 16 Savari (10 of which are on-order)
 - 6 Arada
 - 6 ITRI (option to order 10 additional)
 - 6 Cohda
- SPaT Listeners
 - 2 Legacy Kapsch listeners
 - 1 Savari Android Tablet (10 additional on-order)
 - 1 ITRI Android Tablet (option to order 10 additional)



USDOT Test Bed Hardware Status - RSEs

- All RSEs compliant with USDOT specification 3.0 (Safety Pilot Model Deployment)
- All RSEs updated with the latest firmware based on Safety Pilot lessons-learned
 - IP Data Gateway Support
 - Log File Connection
 - Basic Health Monitoring
 - Enhanced Remote Access
 - Immediate Forward / Store and Repeat
 - Support Multiple Radio Sets
 - Configuration File Support
 - Security Credential Storage
- Intend to update to 3.01 R4 with additional functionality to support the Test Bed
 - Real-time BSM Message forwarding
 - Signed and Encrypted Health Monitoring messages



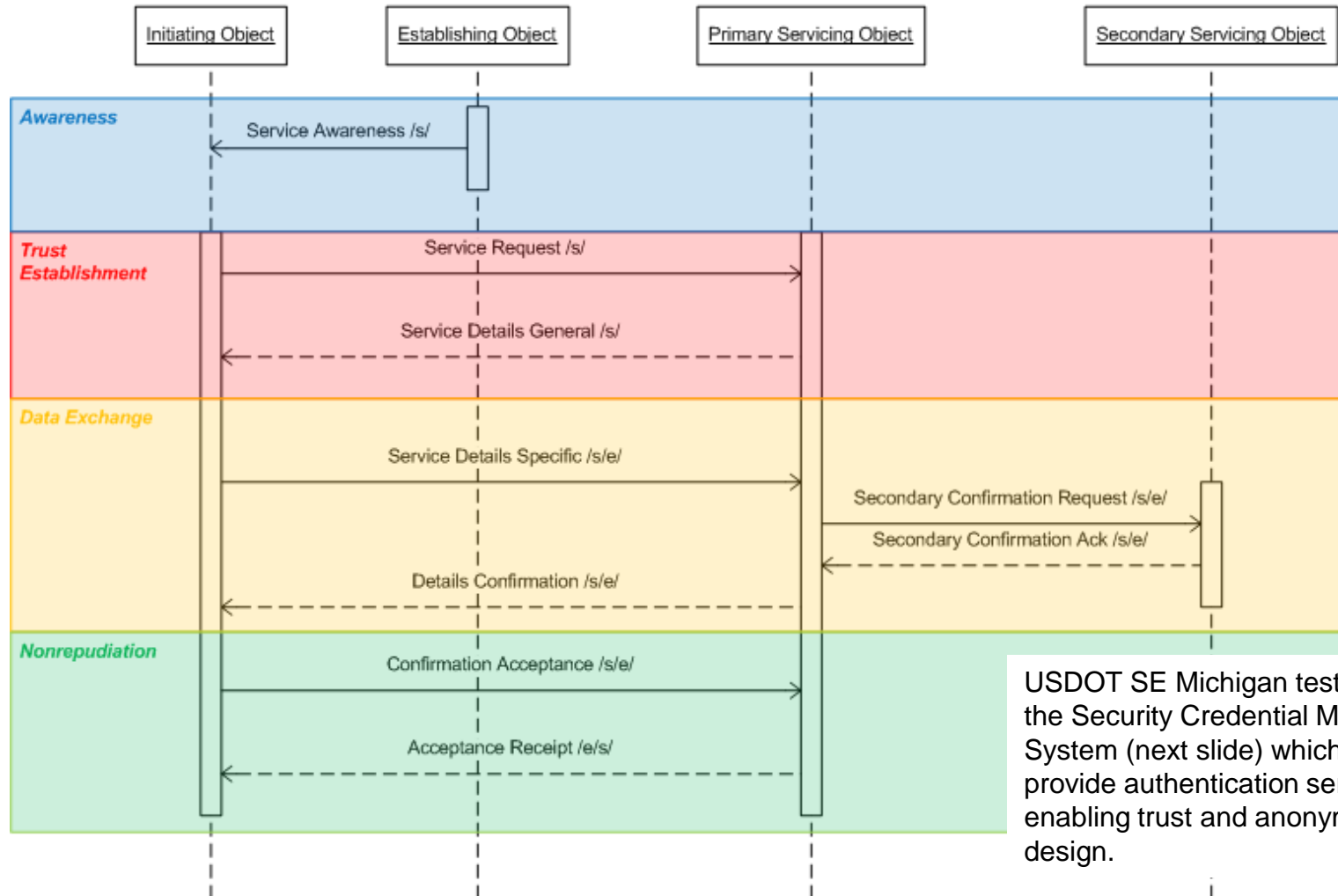
USDOT Test Bed Hardware Status - ASDs

- Using Aftermarket Safety Devices as the base in-vehicle component as they support two-way communications
- Intent is to attach them via Wi-Fi to an Android tablet (or other platform) for application development
- All Test Bed ASDs compliant with Safety Pilot Model Deployment Specifications
 - Support all DSRC messages in Safety Pilot Model Deployment
 - Support over-the-air Certificate Credential Management
- Test Bed ASDs are enhanced to support added functionality as opposed to a single-solution device:
 - Receive SPaT in FHWA “BLOB” and SAE Formats
 - DSRC Message Transmission
 - BSM
 - Misbehavior Report
 - SCMS requests and responses
 - Wireless connection to a tablet or PC
- Working with ASD suppliers to implement Vehicle Situation Data Message (to be discussed later in the day)



Security and the Data Exchange Process

Phases of a Peer-to-Peer Data Exchange Message Sequence

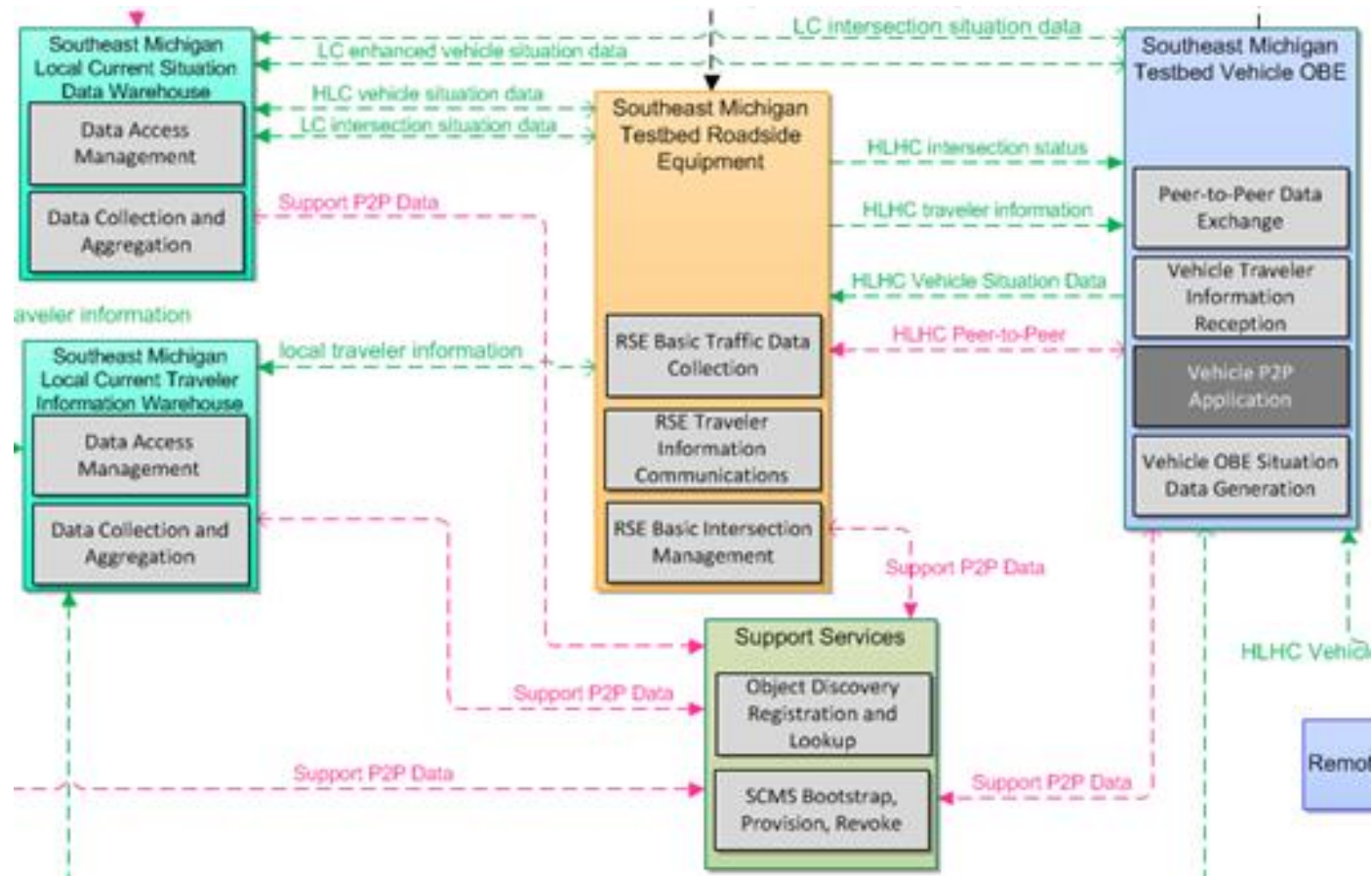


USDOT SE Michigan test bed hosts the Security Credential Management System (next slide) which will provide authentication services, enabling trust and anonymity by design.



Test Bed SCMS Implementation

- Implementation is based on the design implemented for the Safety Pilot Model Deployment and operated by the Test Bed operator
- Updates are planned to support the enhancements proposed as part of this overall implementation



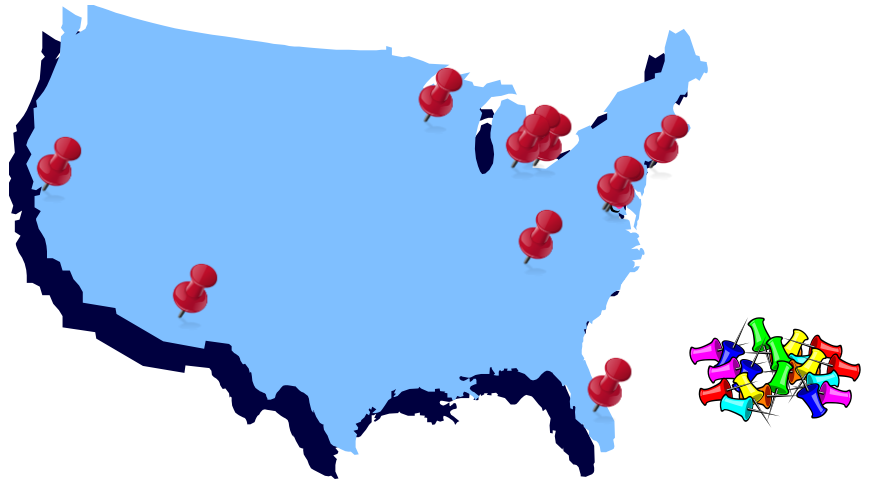
Test Bed Data Systems

- Example: Safety Pilot (26 RSEs and <3000 vehicles):
 - SPaT Data (6 sites): 28,821,437 messages per day
 - MAP Data (6 sites): 2,510,384 messages per day
 - TIM (3 sites): 227,766 messages per day
 - BSM (26 sites): 16,740,785 messages per day
 - Total data per month: 18.4 TB
- How do we deal with all this raw data in the Michigan Test Bed?
 - Backhaul – implementing multiple backhaul technologies to test effectiveness
 - Distribute information – implementing real-time Big Data solutions that are scalable
 - To vehicles
 - To others
 - Long-term storage with USDOT Research Data Exchange



Affiliated Test Beds

- The Vision:
 - **Multiple Interoperable Locations as part of One Connected System**
 - **Moving toward a nation-wide deployment**
- Common Architecture
- Common Standards
- Shared Resources
- Independent Operations



For More Information

U.S. Department
of Transportation



Connected Vehicle
PlugFest

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